These can be documented by ascending phlebography and can also be located immediately pre-operatively using a Doppler technique. As Kistner[17] recommended, one should not hesitate to use combinations of procedures beginning with the simplest as determined by preoperative duplex scanning, and ascending and descending phlebography. Varying interventions in the deep system might be needed; particularly caval or iliac obstructions which can be missed by limb duplex scanning. These respond poorly to perforator interruption. SEPS is a useful and elegant procedure. Results can probably be improved by additional interventions. Among these, extra-fascial ablation of the submalleolar perforators is advisable when these contribute to skin changes.

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THE VENOUS ULCER

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The venous ulcer is the most important epiphenomena occurring in the course of the Chronic Venous Insufficiency (C.V.I.) Syndrome. When present, its onset strongly affects the patient, who is unable to continue his normal activity. In our experience, from 444 cases followed up for 10 years, 50.67% presented an ulcer during this lapse. This percentage rose in posthrombotic syndromes (65.51%) and decreased in those patients who did not present deep venous pathology (46.25%).

As aforementioned, the venous ulcer is a further episode in the course of indurative hypodermitis of the C.V.I. Syndrome, and therefore its pathophysiology is closely related. This disease is a product of the permanent reflux towards the superficial system during muscular contractions, through the insufficient Direct Perforant Venous System.

In our series, patients were evaluated with phlebography and phlebomanometry. Among them, 56,53% had a history of previous DVT and 43.46% showed an intact DVS.

In 1876, Le Dentú described 2 types of perforant veins: direct & indirect. The latter connect the Superficial System with a muscular vein of the leg and thence, through it, run into the Deep Venous System. They do not participate much in the disease, as during muscular contraction, the point of maximal reflux, with pressures ranging from 200 to 300 mm Hg provoke the total collapse of this muscular vein, so avoiding the reflux or buffering its magnitude.

On the other hand, direct perforants are those that directly connect the Superficial System with the deep principal or axial veins, which latter are submitted to lower pressures - 100 to 15° mmHg - during muscular contraction; they do not collapse totally but partially, in the middle. Direct perforants emerge from the lateral partly open edge and, due to the Venturi effect, tend to suction the blood towards the interior of the axial vein.

Direct perforants of the thigh and upper third of the calf run into larger cross-section veins like the Long Saphenous Vein or collaterals of similar caliber. Because of this and once perforant valvular insufficiency is established, the reflux is rapidly neutralized. On the other hand, the direct perforants in the lower part of the leg open up in a fine superficial vein, the Leonardo's vein which is usually of smaller caliber than them. This provokes the important dilatation of these perforants, and the impossibility of the superficial vein to neutralize the reflux, which progressively will reach the capillary bed and finally cause the trophic changes at skin level. We have observed that this situation takes place within what we called "Venous Buffer Circuit", formed by the Long Saphenous Vein to the front, Leonardo's vein to the rear and the LAA at bottom, which links both closing the "superficial circuit" at the submalleolous level. The superior, medial, inferior Cockett perforants and the fourth, submalleolar, which we had described, constitute the participating perforant system. At the deep level, the Posterior Tibial and Internal Plantar Vein complete the circuit. This Venous Buffer Circuit, which in the first stages is able to compensate the reflux by its superficial constituents; when global insufficiency ensues, the circuit fails to compensate the reflux thus creating permanent stasis and retrograde hypertension which transmits to the skin and underlying tissues originating the cutaneous lesions.

When the Deep Venous System participates in the insufficiency either caused by obstructive, essential, posthrombotic reflux, or a combination of these expressions, does not contribute to modify the magnitude of the reflux but its duration, possibly limited by the caliber of the insufficient perforant at the peak of the reflux.

Conversely, and determined by the destruction of the valves, the duration of the reflux is prolonged, as the reflowing blood amount increases and the size of the intervalvular compartments augments. This fact is responsible for the high incidence of venous ulcer.

Microscopically, the zone is severely affected; capillaries look elongated, dilated and tortuous mainly near insufficient direct perforants. Thrombosis of the capillary vessels interferes in skin nutrition process thus predisposing to ulceration. This phenomenon also compromises the initial lymphatics, which play a role in this pathophysiological process.

Norman Browse has demonstrated abnormalities of interstitial fibrinogen in venous hypertension. Plasma fibrinogen level is elevated, and is related to an increase in the inhibitor PAI 1 from the endothelium of the vessels and the smooth muscle of the venous wall. After some time it is possible to observe a fibrin cuff within the papillary plexus of the skin, along with an inflammatory infiltrate basically composed of macrophages and T lymphocytes.

Another very important factor in the reduction of venous hypertension is the calf muscular-venous pump. When hypertrophied, it reduces the intra-muscular pressure in the standing position to less than its half, thus causing functional insufficiency. Ineffective contraction of the pump insufficient to evacuate the DVS, generates permanent hypertension which can start by itself the disease onset. Its maximal expression is the Phlebo-arthrosic Syndrome, characterized by fibrous sclerosis, which advances over tendons and joints, fixes the tibiae-tarsal joint, and impairs the function exerted by the muscle-venous pump thus obstructing the evacuation of the DVS. The result is gigantic ulcers, which tend to heal when the patient is put to rest, but reopen with prolonged standing position.

Not all venous ulcers have a similar behavior. Some of them are due to such a severe deep venous hypertension that collapses arterial capillary flow and originates necrotic foci in the meta-arteriole. These ulcers have an ischemic behavior, and are characteristically small, submalleolar, extremely painful and do not develop the consecutive stages of hypodermitis due to its sudden onset.

Physical Examination of the Ulcers

Debridement should precede physical examination so as to fully assess the characteristics of the ulcers. Localization, borders, bottom, depth, type of secretion, and persistence despite treatment are important points. The latter obliges to rule out malignization which although infrequent, may be present.

Lesions may be unique or multiple, and present variations in shape and size. Progressive growth without treatment may attain after several years the whole circumference of the leg. In the beginning, they present as superficial lesions, but as they increase in diameter, they also gain in depth. Examination of the bed of the wound is essential. When chronic, its appearance is indurative and rough, sometimes with sanious secretion and even presenting satellite adenopathies. During progression, involvement of deep bone and nervous structures may lead to short or long saphenous nerves compromise depending on the localization of the lesion. This produces acute pain which is usually less intense than that of ischemic origin. Superimposed infection may cause reticular or trunk lymphangitis which worsen the outcome.

- **Peri-Ulcer** tissue is primarily affected with capillarytis, and/or streptococcal dermytis. During its evolution, different modalities may be present:
- **Eczematous** with inflammatory features and scabby surface.
- **Paracheratosic** with fine or gross desquamation adopts a psoriasiform aspect.
- **Purulent** exudates.
- **Combinated Forms**.

Depth and extension of the ulcer are very important characteristics to assess the response to medical treatment. Healing is fast when only epidermis and superficial dermis layers are affected, while it is slower when the lesion compromises glandular culs-de-sac: if the ulcer extends to the deep cellular tissues the destruction of generative layers conditions the growth only from the lesion border. In these cases, evolution is relented in proportion to the ulcer size.

Treatment

Venous Ulcer treatment must complete two phases:
1. Ulcer Healing
2. Cure of the disease.

It is essential to treat infection as well as measures to control edema to achieve ulcer healing. Systemic Antibiotic therapy preceded by culture and sensitivity studies, especially when long term duration of treatment is considered very important. Skin care is of major importance to the end of avoidance of superimposed erysipelas or other infections, which may compromise the local lymphatic system.

Edema will be controlled mainly by means of Manual Lymphatic Drainage and adequate elastic compression hosiery, which will in turn increase venous return velocity and provide an external support to the Superficial System. Locally, within the ulcer, repeated saline or non-ionic fluid wash is recommended. When necrotic areas are present, surgical debridement must be considered.

A good granulation tissue to facilitate the ulcer healing can be obtained by applying the most various types of dressings in the shape of gel, colloids, films, tissues or foams according to determined needs (debridement, epitelization, granulation, etc.). When the ulcer size is important, healing must be eased by free skin grafts, collagen implants polyurethane dressings or biosynthetic membranes. Sclerotherapy in the preoperative period has seldom or no indication. Conversely, postoperatively it may help to maintain a good result with time.

Surgical Treatment

Once venous ulcer has been healed, it is necessary to try to cure the CHRONIC VENOUS INSUFFICIENCY disease, by means of restoring normal physiology. This is achieved by surgery, which will be permanently successful if radical and complete. It must be directed to treat all affected territories (superficial, perforant & deep if possible). Long term postoperative follow up is also essential, as future decompensations can be detected and recurrence avoided with minimal post-surgical complements. Before deciding the operation, one must keep in mind the assessment of the calf venous-muscular pump. In case of atrophy, it should be recovered to reduce edema to its minimal expression. If persistent, edema will allow clinical evaluation of the role of deep venous hypertension and its role in hydro-electrolytic retention. Quantitative Duplex Scan, APG, Phlebomanometry, and Ascending Phlebography will determine the magnitude of the lesion of the Deep Venous System and the potential repair possibilities.

Superficial Venous System

When a Long or Short Saphenous Vein is incompetent, total or partial stripping according to the magnitude of the insufficiency is the most adequate surgical measure over all the conservative techniques and compression sclerotherapy given the high incidence of

recurrence of these two latter procedures. Second and Third order collaterals will be excised by phlebectomy or may be complemented by sclerotherapy.

The Perforant Venous System

When the DVS is normal, direct perforants responsible for the decompensation of the Venous Buffer Circuit must be ligated. Whether the DVS is also affected, complete interruption of perforants is mandatory with ligation of normal perforants as well. With time, these vessels are prone to decompensation and the disease will recur. Nowadays the perforant system can be approached by:

1. Through Open Surgery (modified Linton or Cockett operations).
2. Subfascial Videoscopic Surgery.
3. Echo-assisted Surgery.

1. Open Surgery

Despite a traumatic operation, with a large incision, this technique provides radical benefits when an abnormal DVS Syndrome is present, as it is the only one that permits the ligation of normal perforants thus avoiding long term recurrence. Videoscopic subfascial surgery and echo-assisted procedures have a higher percentage of post-operative recurrence in these cases.

Linton & Cockett operations must be complemented by the sub-malleolous resection of the Lower Anastomotic Arc, the retro-malleolar perforants described by Van Limborg, and the fourth perforant. We do not perform the Superficial Femoris vein ligation (Linton), and avoid the incision on diseased tissues. Subcutaneous tissues section should be done in block so as to facilitate healing. Finally, suture of the fascia must be done to preserve the function of the calf muscular-venous pump.

When this modification is carried out, practically as high as a 14.6% of postoperative recurrence in this localization is eliminated.

2. Videoscopic Surgery

As aforementioned its main indication remains the interruption of the perforant system with normal DVS. Access to gastrocnemious and solear sector is good, as it is to the upper direct & indirect perforants of the leg when not localized within the muscular zone of insertion in the tibial medial border or the superior and medial Cockett perforants. This technique definitely does not allow the approach to the 3rd, la 4th, & the Lower Anastomotic Arc and thus this operation must be completed by open surgery at this level.

Its main advantage is the short size of the incision (3 cm.), which carries a better cosmetic result and a swifter postoperative recovery.

3. Echo-assisted Surgery

This operation consists of perforants ligation performed through 0.5 to 1 cm. incisions, previously marked by duplex scan. If necessary, this diagnostic method may be also used intraoperatively. Similarly to the former, it is not useful in the post-thrombotic syndrome, given that the Duplex does not detect normal perforants. Its main advantage upon Videoscopic Surgery is that the subfascial compartment remains unopened, thus leaving it untouched for a future open operation. Besides, it allows a more complete dissection of superficial vessels collateral to the perforants. It is advisable to close the fascial perforant ring with a stitch after it has been sectioned, to avoid further diagnostic confusion in the postoperative period. Thumb fingertip palpation through the incision of the fascia allows also the detection of smaller caliber perforants. The operation must be completed if necessary with the sub-malleolous approach. The cosmetic result is very good, if intradermal suture of the incisions is carried out.

The Deep Venous System

There is a group of patients with lesion of the DVS, in which venous hypertension continues to act upon the interstitial tissues of the leg, despite restoration of functional independence between the DVS and the Superficial System. In these cases, normal pressure levels must be achieved, to allow the patient to lead a normal lifestyle.

We must keep in mind the following items:

- It is essential to the evolution to count with a fully developed muscular-venous pump.
- Clinical examination is crucial for decision making, especially in the young patient with severe manifestations.
- These features are important:
  a. Venous Claudication, which is similar to that of the arterial patient.
  b. Venous ulcer with an ischemic behavior.

Operation must be considered as soon as possible, mostly if the patient is young, to achieve the best results in terms of prompt recovery without previously damaged connective tissues and skin. Duplex scanning, either qualitative or quantitative, and APG will be able to measure the magnitude of reflux and presume surgical chances. Once intervention is decided, ascending and retrograde phlebography are indispensable not only to assess the reflux or the obstruction quantification, but also to appreciate the potential resources for the reparation. Despite the fact that surgical procedures per-formed on the DVS exceptionally bring a physiologically complete restitution, partial results are usually compatible enough for the patient to lead a normal life.

Valvular insufficiency has an excellent surgical solution by means of valvuloplasties, original techniques developed by Dr. Kistner, which can be carried out either externally or internally; when not feasible, transpositions to the vertical branch of the Profunda Femoris from the Superficial Femoral constitute a very good alternative.

Venous valvulated bypasses with preserved veins allografts are in a developmental stage, with encouraging possibilities.

Palma Operation (1958) is indicated in obstruction or subocclusion of the Iliac and/or high Common Femoral segments, when the organism mechanisms are not enough to compensate venous hypertension, thus expressing by severe symptoms and signs at the level of the leg. Despite this compensatory mechanisms are directed towards the support of other natural bridges developed to overcome the obstructive problem, they are usually not enough. In these cases, patency maintains permanently and the patient experiences a substantial progress. Many other operations on the DVS have been relegated due to their scarce success in the long-term follow-up. In the Phlebo-Arthrosic Syndrome, the surgical consideration remains depending to the recovery of the tibio-tarsal joint mobilization, which rigidity is a characteristic of this Syndrome. Once mobilization is achieved through cinesitherapy, the venous affected systems will be then considered to be treated according to what was previously expressed.